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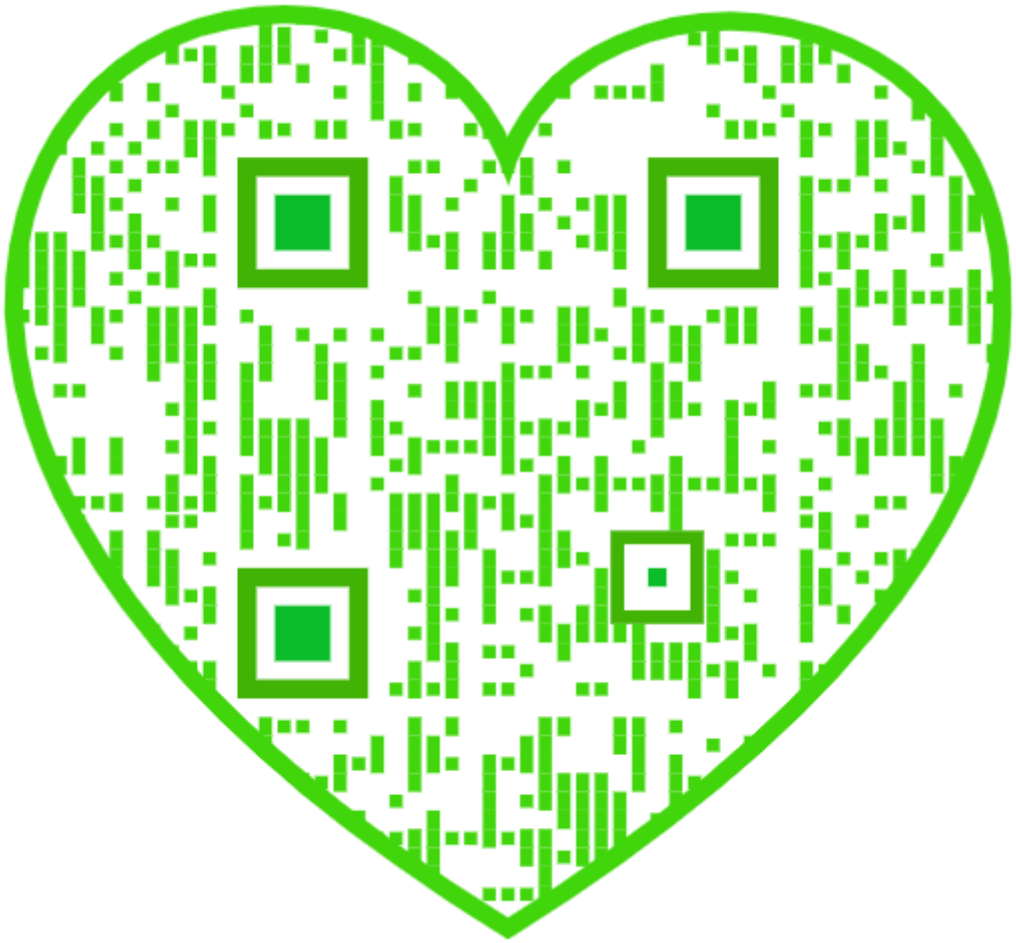

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BEEKEEPING FOR NEW HAMPSHIRE

By William H. Wolff

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In the following pages the writer has drawn freely on his own experiences and on the writings and experiences of the recognized masters of this subject: especially has he made use of the excellent research work of Dr. E. F. Phillips and Mr. George Demuth of the U. S. Department of Agriculture, and of the writings of A. I. and E. R. Root, of Chas. and C. P. Dadant, of Mr. F. C. Pellett and of Dr. C. C. Miller. The writer appreciates the assistance received from Dr. Phillips and Dr. B. N. Gates, both of whom were kind enough to read and criticize most of the manuscript during its preparation.

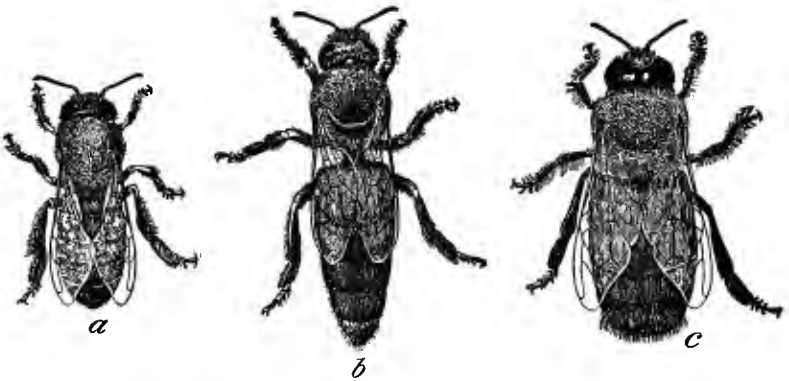


FIG. 1.—The honey bee: *a*, worker; *b*, queen; *c*, drone. Twice natural size. (After Phillips.)

BEEKEEPING FOR NEW HAMPSHIRE

W. H. WOLFF

Bees are kept for two main reasons: first, for the products of the bees themselves,—honey and wax,—and second, for the part they play in fertilization of flowers.

Bees when properly housed and free from disease require only a minimum of care; in the main they look out for and feed themselves. Every colony under normal favorable conditions may be counted on to produce an annual surplus of 25 to 50 pounds of honey worth $5 to $10. Exceptionally strong colonies in the hands of an expert often yield 75 to 100 pounds or more. Such are the benefits and profits of beekeeping when the bees are given a fair chance.

Beekeeping has scarcely had a fair chance in recent years in New Hampshire, fewer bees are kept now than formerly, and instances of successful honey crops are less frequently found. There are four natural causes which have acted to repress the industry:

(1) The presence of foulbrood diseases, especially European foulbrood, mostly unsuspected and uncontrolled.

(2) The presence of many colonies of black bees and hybrids which are difficult and disagreeable to handle, and especially subject to European foulbrood. Modern beekeeping calls for the Italianizing of all colonies.

(3) Insufficient protection for the colonies in the fall, winter, and early spring.

(4) Uncontrolled swarming. Modern beekeeping, while recognizing the inherent tendency of the bees to swarm under certain conditions, aims to so control and modify these conditions as to eliminate natural swarming with its consequent loss of many swarms and the usual reduction in the honey crop even though swarms are caught.

It is felt that in proportion as beekeepers recognize the importance of these four vital points and take pains to correct them will the industry improve and prosper.

WHO SHOULD KEEP BEES

Modern beekeeping is a science, and its successful pursuit is an art demanding considerable practice and experience. The honey crop depends more on management of the bees than on season, so that, while the honey yield will often average for large apiaries fifty pounds for each colony under good and proper care, without this care little or no honey may ever be produced.

This, however, is not the whole story. The person who has from one to a few colonies of bees, who knows little respecting them and perhaps cares less, is a menace to the industry, since his colonies sooner or later are very likely to become diseased. These,

then, under neglect, will return no profit and will serve only as centers of disease infection for all bees in the community.

For these reasons, while naturally a certain number of new beekeepers must and will begin the work each season, it does not seem wise to advocate indiscriminately large numbers of persons starting in each season as small beekeepers. It is believed that better progress from the standpoint of the industry is to be made rather by encouraging those who now have bees and are interested in them to improve the beekeeping practice and to develop larger apiaries.

BEES AND BLOSSOM POLLINATION

It is well known that the pistils or female elements of the blossoms of many varieties of our common fruits are not capable of fertilization by the pollen of the same variety, also that many excellent varieties of strawberries and grapes produce little or no pollen. These are known as self-sterile varieties; many other varieties are partially self-sterile. From a long list of experiments it seems right to conclude that nearly all varieties of fruits are benefited when their blossoms are subjected to cross pollination with other varieties of the same species. This work of pollination constitutes undoubtedly the chief economic value of bees.

Bees often do not fly far from their hives in cool showery spring weather such as occurs in northern New England at blossoming time; hence it is highly probable that yields of fruit may be largely increased by keeping colonies of bees in or very close to orchards.

THE PRESENT A GOOD TIME TO START BEEKEEPING

The results of recent investigations have removed much of the element of chance from beekeeping. This is a good reason for believing the present to be an opportune time to increase one's colonies of bees, or to make a start in beekeeping. We now know much more of the fundamental principles governing such phases of beekeeping as wintering, feeding and the control of diseases. There will always be good opportunities in this industry when the yields, through better beekeeping, are brought up to 50 pounds or more of honey per colony. Sometimes, but rarely, one finds this being done now; with a better understanding of fundamental principles it is sure to be more frequently accomplished. One very bright feature of the case is that the field of beekeeping in this state is certainly not overworked. In New Hampshire there is still plenty of room for bees and excellent markets, as yet but partially developed, for the finer grades of clover and wild raspberry honeys that are naturally produced.

THE HOME OF THE BEES

The natural home of the wild honey bee is in a hollow tree, or, in milder climates, in an opening under a rocky ledge or in some hole in a cliff. For several hundred years man has kept bees in a semi-domestic state, but they have in no sense lost their inherent wildness or ability to take care of themselves as have many of our domestic animals, but will just as happily go back to the hollow tree, emerging through some knot hole, as to live in the best painted up-to-date hive.

A good hive must meet two requirements:

1. It must be a good and comfortable home for the bees. It may be noted here that neither the single-walled hive nor the double-walled hive affords protection enough to the colony during late fall, winter and spring. This is further discussed under the heading of "Wintering."

2. The hive must be so constructed as to enable one readily to examine the condition of the colony and to conveniently perform the various operations required in modern beekeeping.

A hollow tree may ideally fulfill the first requirement of providing a comfortable home for the bees, but the second is only supplied by the movable frame hive, with its various parts separate and interchangeable.

THE MODERN HIVE

The modern hive (Fig. 2) consists of a box or body with separate top and body and with the combs of the interior built on hanging, readily removable frames. A bee-way, or bee-space of $\frac{1}{4}$ to $\frac{3}{8}$ of an inch, is provided for on both sides and ends of these frames.

Hives are made to contain usually eight or ten frames; the latter size is by far the more common and may be considered the standard. The Jumbo and the large Dadant hive are also used, especially for extracted honey production. A sheet of comb foundation reach-

ing from the top to within an inch of the bottom bar should be used in each frame; this foundation is of pure beeswax, rolled into a thin sheet, on each side of which is impressed the foundations or bases of worker cells. Large sheets of foundation in the frames are economical in several ways: first, the bees are saved the necessary consumption of honey and the time necessary to secrete wax and build this much comb; second, their use also encourages the bees to build straight combs which can be more easily lifted out and, if desirable, transferred from hive to hive; finally they encourage the bees to build more nearly perfect worker celled comb with less drone brood comb. The raising of drones in

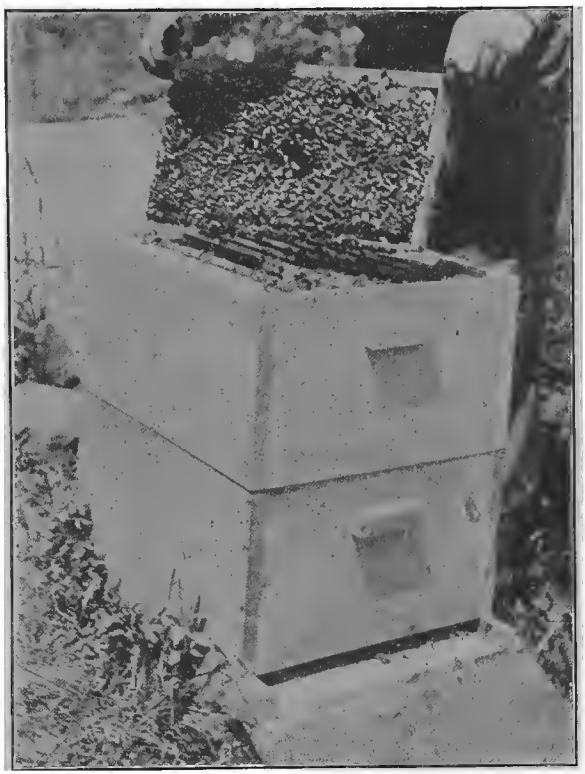


FIG. 2.—Visiting the home of the bees.

large numbers is expensive in honey and tends to cause swarming. Frames and foundation should be reinforced with fine wire strung tightly from side to side; this is embedded into the wax foundation, thus serving to strengthen the combs. It is especially important where combs are extracted, and, since it also tends to prevent sagging and stretching of foundation near the top bar, results in more nearly perfect worker brood comb.

Another separate part of the modern hive is the "super," which during a honey flow is placed above the brood body, and which serves to hold the extracting frames, or the small square or oblong section boxes for comb honey. Wax foundation starters, or full sheets of thin foundation, are used both in the super frames and in the sections.

The hive stand and the alighting board, while detached from the hive, are really important parts of the same. A hive must not rest on the ground, else the bottom will be damp and tend to rot, nor is it best to raise the hive far from the ground, since, besides the inconvenience of working with the colony in such a position, here in the north the

reflected heat from the soil surface in spring and fall is no doubt helpful in brood rearing. A stand of wood, stones or bricks raising the hive four to six inches above the ground surface is believed to be best. The stand should provide a slight slope toward the hive entrance to keep out water. An alighting board sloping from the ground to the entrance of the hive is also useful in saving the bees time and helping them gain ready entrance to the hive when they return heavily laden with nectar or pollen. All of these hive parts are shown in Figure 2.

ADDITIONAL EQUIPMENT

In addition to the hive and its parts, the following accessories should be provided to enable proper and convenient manipulation of the bees:

1. Smoker. In constant use when working with the bees.
2 Bee-veil. Always desirable and nearly always necessary.
3. Gloves. For beginners especially necessary; as experience is gained they are frequently discarded.
4. Hive-tool. In constant use. A screw driver or strong putty knife will serve the purpose fairly well.
5. Bee-Escape-Board Fitted with Porter Bee-Escape. Especially useful in removing supers of comb honey.
6. Queen-Excluding-Boards. Either the wire or the perforated zinc type. Essential where the queen is to be confined to one body as in producing extracted honey.
7. Wire, for wiring frames.
8. Wire Embedder.
9. Wax foundation. The heavy or medium weight for brood frames and the thin super foundation in case section honey is to be produced.
10. As many additional hives as are needed or as are advisable for making increase of colonies.
11. A Section Foundation Fastener. There are several good makes. An excellent one is made by A. A. Byard of West Chesterfield, N. H.
12. In case comb honey is being produced, at least four or five supers for each strong colony should be on hand at the beginning of the spring honey flow; for extracted honey two extra bodies of nine frames each should be provided for each strong colony.
13. An extractor, a bee brush, an uncapping knife, a settling tank and bottles or other receptacles must also be provided where extracted honey is to be produced.

LIFE HISTORY OF THE BEES AND ORGANIZATION OF THE HIVE

Let us examine a strong healthy hive of bees some bright morning in June when both nectar and pollen are being brought in, and select for this examination, if possible, a hive of pure bred Italians; for while during a good honey flow all bees are more or less docile, it is a decided pleasure to work with Italians, since they will mainly continue their various duties, and the queen even her egg laying, seemingly little concerned as to our presence and inquisitiveness.

First, we observe that there is a continual stream leaving the entrance and another stream arriving; some of these latter are heavily laden with pollen bearing a little mass on each hind leg; and while the others do not show it, they too are working carrying in nectar, from which by the evaporation of most of the water they produce their honey.

Second, we notice a few bees just in front of the hive entrance. They are facing the entrance and are standing almost on their heads, with abdomen pointing upwards and with wings in rapid motion. These are the forced-draught operators, fanning a current of air inwards and upwards over the combs, partly for ventilation, but chiefly to evaporate the large amount of water from the nectar recently carried in.

Still other bees are acting as entrance guards. They aim to satisfy themselves, apparently by sense of smell, that every bee entering the hive is a member of their own colony. They are ever ready to start the fight of defence against robber bees from other colonies, which are sure to be lurking around in times of nectar shortage, especially if they suspect the hive of weakness. These sentries also aim to keep out bee-moths and other insects, and to drive off animals and man unless he observes certain rules of the game known to beekeepers.

The bees which we have so far noted are the workers, of which there are often 50,000 to even 100,000 or more in the case of exceptionally strong colonies. These workers are in reality females, but not completely developed sexually. They never mate, but under certain conditions where a hive is without a queen one or more of them sometimes develops egg laying, but lays only unfertilized drone-producing eggs. In addition to

the various duties named above, these worker bees secrete wax, build comb, keep the hive cleaned up, and incidentally generate the heat necessary for brood rearing and for wintering.

The drones, or male bees, are found in and about the hive during late spring and summer. They vary in number from a few dozen to several hundred. They are larger than the workers, with heavier bodies and without stings. Their sole purpose is to mate with the young queens. Only one drone mates with and fertilizes a given queen, and this only once in her life during flight in the air, about a week after emerging from the cell. From then to mating a queen may lay for two or three seasons a total of two to three million eggs. The drone dies immediately after mating. The other several hundred drones are raised at the expense of the colony during the summer.

In the fall they are all driven from the hive by the workers, to starve and die. Their numbers should be kept down by using full sheets of worker foundation and by using

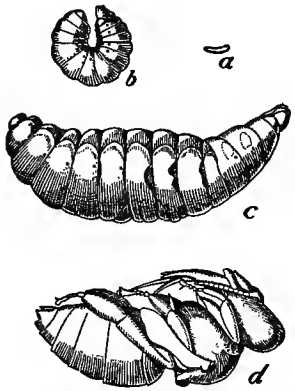


FIG. 3.—The honey bee: *a*, Egg; *b*, young larva; *c*, old larva; *d*, pupa. Three times natural size.

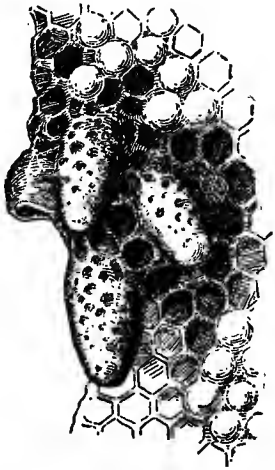


FIG. 4.—Queen cells. Natural size.

frames which contain a large percentage of drone cells only in extracting supers above a queen excluder.

We now continue our investigations on the inside of the hive. Giving the bees first a few puffs of smoke at the hive entrance we pry off the cover gently and remove and examine each frame in turn. The one or two outer frames on each side will probably contain honey only. The frames in the center of the hive, where the temperature is highest and evenest, will constitute the brood "nest," and the cells of these will be seen to contain eggs, young bees (larvæ) and sealed brood. On one of these brood frames will be found the queen. She is larger than the worker bees, with longer abdomen, and is of slimmer form than the drones and with shorter wings. If she is an Italian queen, as a rule she will be more easily found than if a black queen, and she will not be much disturbed. While we are watching her, she will most likely continue her egg laying, curving her abdomen into an empty cell every few seconds and depositing therein on the bottom a small cylindrical pearly-white egg. Often in the height of the honey flow a queen will lay as many as 2000 to 3000 of these eggs each twenty-four hours. Most of these will be laid in the worker cells, but eggs will also be laid in the drone cells wherever patches of these have been built. In case the swarming impulse is on, we will also find several long peanut-shaped queen cells pendant from the sides or bottoms of the combs. The same kind of fertilized eggs is laid in these as in the worker cells; the difference in development is mainly and perhaps wholly due to the specialized food, so-called "royal jelly," fed the growing young queen or queen larva.

All eggs require about three days to hatch, but the larval feeding period varies for each of the three kinds of bees. The pupating or transforming period also varies slightly.

The entire period elapsing from the day the egg is laid until the full grown bee cuts its way through the cell cap and emerges is in the case of drones about 24 days, in the case of workers about 21 days, and of queens only 15 to 16 days. Usually about a week passes before the queen is ready to mate, or the young workers are ready to go to the field for nectar and pollen; these latter are believed to employ themselves during their first few days mainly in the work of feeding young bees and in building wax.

MAKING A START WITH BEES

The beginner in beekeeping will find it much to his advantage in addition to his reading and studies to visit some progressive beekeeper and receive from him a practical demonstration on the manner of opening hives and handling bees, and to practice this work with him if the opportunity affords.

Without experience a start had better not be elaborate. In general it will be advisable to start with two or three colonies and to gradually enlarge as success attends one's efforts. There are several ways of making a start in beekeeping.

(a) **Buying colonies.** The best and surest method of starting beekeeping is to buy healthy Italian colonies in the spring of the year in good condition and in modern hives. If these colonies are strong and are to be moved any distance in warm weather, a wire-cloth screen should be nailed over the top for ventilation. Following this at night, after all bees are in, the entrance should be closed with wire cloth, and the bottom securely stapled to the hive body. The hive covers should be removed during the moving of colonies, or while they are standing closed, to provide a circulation of air up through the entrance screen and out through the wire cloth covering the top of the hive body.

(b) **Hiving swarms.** Another way in which many beekeepers have secured their start is by finding and hiving clustered swarms. The method of hiving a swarm is simple. It is best, of course, to hive the swarm directly into a modern movable frame hive with combs or sheets of foundation. If such is not at hand, then it is good practice to hive them temporarily in an ordinary box and transfer them later to a movable frame hive. The swarm is hived by cutting off the branch with the cluster of bees, holding this over the box, or movable frame hive, and vigorously shaking off the bees into the same. One need have little fear of stings when hiving a newly emerged swarm, since just before swarming bees so fill themselves up with honey that they have little disposition to sting for several hours. As an insurance, however, and to lend added confidence, it is always well to wear a black mosquito netting or wire veil. A swarm starts to build comb and rear brood as soon as hived, and it is desirable in case any amount of brood is started that this be saved and transferred from the box to the frames of the movable hive.

Buying nuclei, buying bees by the pound, or transferring from box hives all call for considerable judgment and dexterity in manipulation. As a rule, therefore, these methods are better suited to persons with some experience than they are to the novice. Hence, if the beginner has no expert assistance, he will do well to start with swarms or full colonies and use one or more of the following methods perhaps later on as a means of increasing the number of colonies in his apiary.

(c) **Buying nuclei colonies in the south.** Good colonies are frequently built up by midsummer from two or three frame nuclei with queen bees and unhatched young (brood) secured in early spring. Frequently a small surplus of honey is produced from the resulting colonies the first year. The writer has observed numbers of these nuclei which have come through by express from Mississippi to beekeepers of Hampden County, Massachusetts. In a large percentage of cases they have arrived in perfect condition and built up into strong colonies.

(d) **Buying bees by the pound.** Another method now used successfully is to buy bees by the pound. It is claimed they usually ship better when they have a queen with them. She may be enclosed in a small cage within the larger package of bees, or if she has been previously introduced to these bees she may safely be shipped loose with them. When the queen is shipped with the package bees, she may be released at once with these bees, but in other cases the usual methods of queen introduction should be used.

(e) **Transferring colonies from box hives.** As stated before, it is very unwise to keep colonies in old-fashioned box hives. The beekeeper may therefore desire to transfer some of his own bees to movable frame hives from box hives, or he may have the opportunity to buy good strong colonies in box hives and transfer these. Transferring is accomplished by smoking the bees thoroughly in the box hive, then making a small opening in the top of the same, boring two or three good-sized auger holes in the bottom of the new hive and setting the latter over the former so that the opening in the old and

the auger holes in the new coincide and form a continuous passage for bees. The entrance to the new hive is then closed and the bees are driven up into it by blowing smoke in at the old entrance and drumming for ten minutes or so with a block of wood or light mallet on the sides of the old hive. If possible a frame of brood should be provided in the new hive. This may be obtained from a colony already on hand, or it may be made up of pieces of comb with brood taken from the old box hive and patched together in a frame by the using of string, wire or small wooden cleats.

Whichever way the start be made it is well to go slowly in making increase. Do not try to divide weak colonies, and as a rule it will be found inadvisable to divide colonies in New England later than August first. The golden rule in beekeeping is to keep colonies strong at all times.

THE APIARY SITE

The site or particular location for the apiary should be selected with care, as it will have much to do with the degree of success possible in the particular venture. In healthy colonies provided with plenty of stores the amount of early brood rearing depends mainly on the temperature which the bees can easily maintain within the hive. Successful wintering also depends on this same factor. It is, therefore, important to select well-sheltered apiary locations. A natural or artificial windbreak of evergreen trees or shrubbery on the north and west sides, if possible, should be provided. If such is not at hand, a slatted or lathe windbreak fence about six feet high may be constructed. It will pay for itself in the stronger colonies and larger honey yields resulting from such protection.

Dense shade is a great disadvantage to bees in New England, since it tends to keep the hives too cool for the maximum rearing of brood in the spring and fall. Taking everything into consideration, the best position is afforded by open sunlight with no shade. On very hot days shade may be provided by temporary shade boards.

OPENING HIVES AND HANDLING BEES

If one is a beginner with bees, I suggest that he should take proper insurance against being badly stung during the first days of ownership. A few bee stings are not serious, still they are temporarily painful, to say the least. But, worse than all this, to be badly stung at the start is almost sure to cause one to be nervous and hurried in the operations about the hives, to fall down in one's plan and to make incomplete and faulty observations.

The following suggestions will help avoid this painful experience:

1. Use only Italian bees. Not only are they gentlest, but they are the most satisfactory kind of bees in many ways. If one has black bees, dequeen each colony in late July or August after the main honey flow and introduce an Italian queen.

2. Wear veil and gloves. One may soon discard the gloves as experience and confidence are gained, but the veil will always be in order.

3. Have smoker lighted and going well. Dry burlap or punky dry wood are both good material to burn in the smoker.

Before starting work on a colony, blow a few puffs of smoke in at the entrance and wait a minute or two for the bees to feel the effect of it and quiet down. Then pry off the cover gently and blow a little smoke over the tops of the frames. Do not hold the smoker close to the bees, as the smoke is hot and may injure them. Avoid using more smoke than is absolutely necessary.

4. If possible, avoid opening hives in cold, wet weather. Bees are usually more gentle during the warmer part of the day and when the sun is shining directly on the hives. There are several reasons for this: first, large numbers of the workers are away in the fields; second, those at home are busy within the hive; third, the bee glue, or propolis, with which they seal together all hive parts, is soft and will permit the hive to be opened and the frames lifted out without the cracking and jarring incident to breaking the hardened bee glue in cold weather. All jarring of the hive tends to excite the bees and promote viciousness.

It should also be borne in mind that almost any colony will be more or less vicious when there is a dearth of nectar during the flying season. Colonies which have lost their queen usually show more fighting spirit than at any other times, and extreme viciousness in a colony usually gentle should lead one to suspect that they may be without a queen. The regular hive tool, a chisel or a screw driver should be used in opening hives and starting frames. One should learn to use the customary method of handling frames,

since it is easier and will prevent the breakage of combs. The method is as follows: Remove cover and with the hive tool pry loose each end of a given frame; grasp these ends and slowly lift the frame straight up out of the hive and examine the side of the comb in front of you; then slowly drop the left hand until the top bar is perpendicular, and with the top bar on the axis turn the frame to the left till the other side is in full view; examine this, reverse the movements and set the frame to one side or replace it in the hive.

Carry on all operations about the hive with slow deliberate motions. Maeterlinck, the noted Belgian naturalist, quaintly and well wrote of "using large slow gestures" so that his bees might regard him as a sort of natural catastrophe which it was useless to try to combat.

COMB HONEY OR EXTRACTED HONEY

During the war period and immediately following the same, honey was in great demand to replace the sugar shortage. The wholesale price of the better grades of extracted honey was around fifty cents a pound. Large profits per colony were made by many beekeepers who understood the business and had their bees in good condition. The writer knows of many colonies which turned in honey to the value of sixty to seventy-five dollars in a single season.

But honey is now back again to pre-war prices, and the advisability of changing the methods of handling colonies and of producing the honey crop must be considered by every beekeeper. Shall he continue to produce the extracted article, or shall he change over to the production of comb section honey?

First, it must be remembered that extracted honey is usually easier to secure. Colonies can be kept stronger in bees; they are likely to be more free from disease, and swarming is almost automatically eliminated by the ability to give the queen abundant space for brood rearing. Second, bees apparently prefer to store honey in large sheets or frames, rather than in the small sections. Experience shows that as a rule 25 per cent to 50 per cent greater weight of extracted honey may be expected of the same colony than of comb section honey.

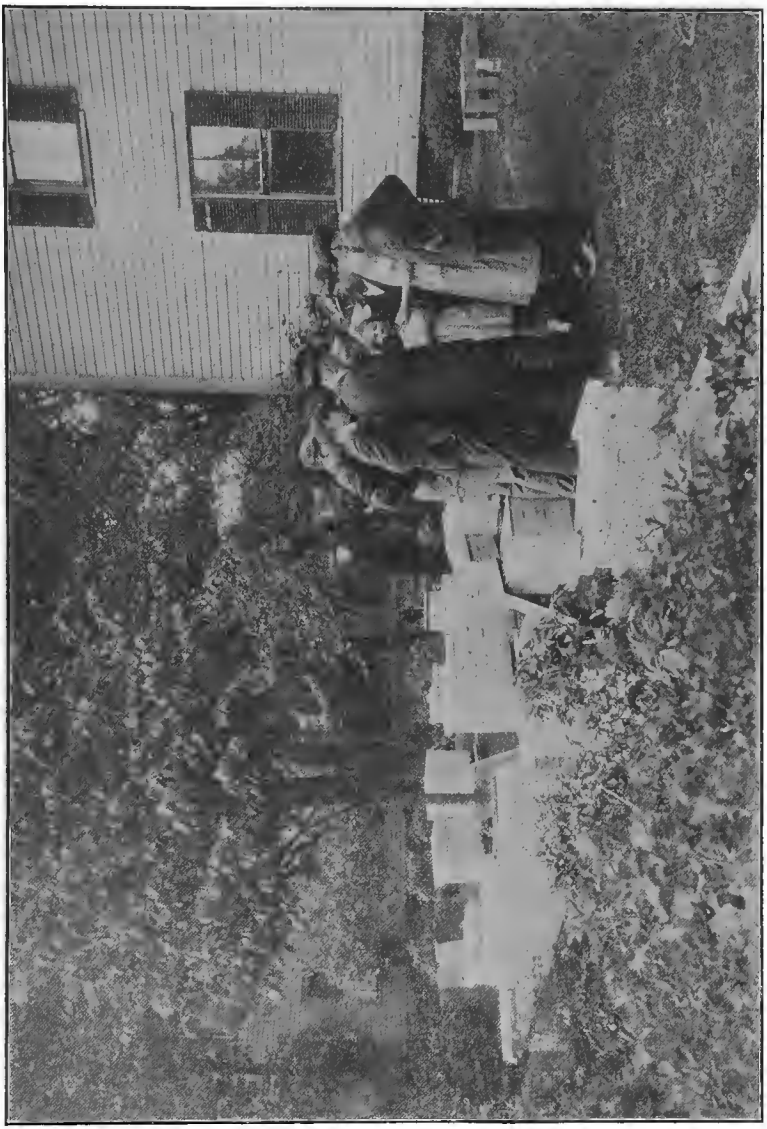
There is no doubt, too, that extracted honey is coming to be more generally used each year, due to the fact that it is better advertised and more attractively marketed. Part of its increase in popularity is also due to the fact that all material labeled "honey" must be guaranteed under the national pure food and drug act as the natural product of the bees' industry.

The centrifugal honey extractor does its work well and quickly, and extracting is not the disagreeable job it is often supposed to be. Extracted honey to be bottled should at first be allowed to settle for a few days in a deep tank, then drawn off from the bottom, heated carefully to 155° F., and bottled while hot to prevent granulation. The bottles should be wide-mouthed, of neat design, of medium size, the half-pound and one-pound sizes usually being preferred, and should be neatly labeled. They should also be perfectly clean and free from traces of honey on the outside.

But while extracted honey is a standard article of food, the beautifully capped sections of white clover or wild raspberry honey are thought of as a fine confection, a natural delicacy, finding always a welcome place on the best tables. Honey in this form is selling today for two to three times the price of an equal weight of the extracted article. No expensive extracting or bottling equipment is necessary; and the sections, except for the removing of bee glue or propolis, are ready for sale the moment they are taken from the hive. It is true that more skill and attention is required to produce comb honey; but there are undoubtedly many, especially of the smaller beekeepers, who during the last two or three years have developed skill in handling bees for extracted honey and who would benefit under present conditions in changing over mainly to the production of comb section honey. We have used the word "mainly" advisedly, for experience shows that it pays to give sections only to really strong colonies. Colonies that are not literally "boiling over" with bees when the white clover or wild raspberry honey flow starts had better be run for extracted honey with two bodies during the entire season, or first be given a super of shallow frames, and later under this, one of sections after the bees have started work well in the former.

SWARMING

Swarming in New England mainly occurs in May and June. Swarms usually emerge on a warm day between nine in the morning and two in the afternoon. Swarming, under certain conditions, is a natural instinct, but the up-to-date beekeeper by modifying or



Bees are fascinating creatures when you give up your fear and study them.

changing these conditions plans to prevent the development of the instinct, the "swarming fever" as it is called, and to secure the desired increase in other, safer ways.

The colony among bees is the unit, and swarming is nature's method, not only of increasing the number of colonies, but also of perpetuating the original colony. The latter is made possible by the habit of the old queen of leaving with the outgoing swarm and surrendering the all-important work of egg laying in the old home to the young daughter.

If a colony can be built up strong and these forces can be held working contentedly together during the main honey flow, as, for instance, when white clover is in bloom, that colony is almost sure to be able to gather considerable surplus. On the other hand, if a colony, strong in numbers, swarms in the beginning of or prior to the honey flow, as it is likely to do without attention, neither the parent hive nor the new swarm may be able to gather much more than they need for maintenance. For this reason, and because many swarms are lost, beekeepers have for years given much thought to means of controlling and preventing natural swarming.

The principal factor which appears to induce swarming is the crowding of the hive with bees and brood at a time when stores are being brought in in small to moderate amounts. In case a colony can be brought up to the white clover flow without developing the "swarming fever," they will invariably not develop it while rapid storing is in progress, provided they are given plenty of storage room.

When the swarming fever is developed, the bees set to work to build queen cells, the queen lays in these, and with their development swarming is sure to follow. The first swarm, with the old queen, leaves soon after the queen cells are sealed over and, if nothing is done to prevent it, a second swarm is likely to issue in a week to ten days after the first.

CLIPPING THE QUEEN'S WINGS

The practice of clipping the wings of the queen will help temporarily to prevent the loss of the swarm, since the old queen will not be able to fly and the bees finding that she is not in the cluster, will return to the old stand. This, however, is only a temporary preventive of loss of swarms; for if conditions within the hive are not quickly changed, the bees, after making one or two false starts with the old queen, will finally kill her and swarm with a virgin queen. The queen may be held in the fingers or against the comb while wings are being clipped. Cuts should not be made too close to the body, and it is usually well to leave wing stubs about an eighth of an inch in length.

SWARM PREVENTION

The dependence on natural swarming invariably results in the loss of some swarms, and it requires much daily watchfulness on the part of the beekeeper during the period when swarms may be expected. For these reasons the tendency at times is to use strict repressive measures planned to do away with natural swarming altogether and make increase in other ways.

Whether colonies are run for extracted honey or for comb honey, a very good plan of management up to the beginning of the early honey flow is the same in either case. This consists in giving the queen plenty of room in the early spring, preferably using for the brood chamber two bodies with eight or ten frames each at all times, except during the main early honey flow.

SWARM PREVENTION IN WORKING BEES FOR EXTRACTED HONEY

When colonies are run for extracted honey, swarm prevention is relatively simple. The use of larger hives with more roomy brood-nest and honey storage space as suggested above, automatically does away with most of the impulse to swarm. The few cases that do develop may be readily taken care of by manipulation of the brood. The colony is run in two Langstroth bodies, or the colony which wintered in one story is given an additional body in early spring, some time in May, or as soon as it needs the space. A month later the queen with a frame or two of brood is placed in the lower body, and the rest of the space in this is filled with empty frames or frames containing little brood and stores. The rest of the brood is placed in a second body set over a wire or zinc queen-excluder above the body containing the queen. As soon as the brood above the excluder hatches, the cells are used for honey storage, since the queen is not able to lay in them. Colonies so treated will rarely swarm and will produce the maximum crop.

Queen cells are likely to be built above the excluder when the above method is used. They should be removed on the seventh or eighth day.

Swarm Prevention in Working Bees for Comb Honey

The colony should be run in two bodies during early spring and up to the time of the main early honey flow, as described under the general heading of "Swarm Prevention." Manipulation then becomes necessary to secure the crop. There are several plans, but the two following are among the best and most simple.

Plan 1. As soon as the honey flow begins, place all the brood in one body and put on the first super for sections. If there are queen cells present at this time, or if there are indications later of their formation, cut them out, catch and cage the queen, and place the cage containing her just within the hive entrance, allowing it to rest on the floor of the hive wire-cloth side up. The bees will feed the queen through the wire. Leave the cage with the queen thus for ten days, and at the end of the period release her and again cut out all queen cells. It should be noted that, in case no queen cells are started when the first super is given, and the bees start work promptly in the supers, if additional supers are given properly, as a rule there will be no attempt to swarm while the honey flow is on.

Plan 2. Ten days before the main honey flow is expected, place a queen excluding honey board between the two bodies. After ten days examine and note which body contains eggs and young brood. The queen is in this one. Find her, and transfer her and the frame on which she is to the other body, taking out a frame from the same to make room for this frame with the queen. Remove the hive in which the queen has been laying for the past ten days and give it a queen cell in a spiral wire protector, or give it a virgin queen. Set it close to the hive containing the old queen, but with its entrance turned at right angles to the former position. The hive on the old stand with the old queen now has most of the flying bees and for the time being will be the storing colony. Give it the super. Within two days, turn slightly the hive containing the queen cell or the young queen, and within two days more finish turning this hive until its entrance is close up to the old hive and in line with the same. After a week to ten days, or as soon as the young queen begins to lay, set the hive containing her on the old stand in the place of the other hive and move this a few feet off to one side. Transfer the super now to the colony with the young queen on the old stand.

Plan 2 may seem a little complicated until it is first gone through with, but it is relatively simple. It comprises two big factors in swarm prevention, namely, a week to ten-day period in which no eggs are laid, together with a young queen of the season's hatching in the storing colony.

PROPER SUPERING

Placing supers on at the right time is as important as anything in keeping down the tendency to swarm in comb honey production, and also in helping to secure the maximum crop. I think we cannot overemphasize the fact that as a rule, if the tendency to swarm is not present when the main flow starts from white clover or wild raspberries, if the bees are given plenty of storage room in supers, and if supers are given properly, they will not develop swarming while the flow is on. The second super should be given underneath the first as soon as the first is well started. The third super should be placed under the second when this is well under way. As many as five or more supers may be needed to hold the crop gathered by very strong colonies in a good season. Towards the close of the season care should be taken not to give super room much in advance, else there will be a large number of unfinished sections.

FEEDS AND FEEDING

Good Management Will Make Feeding Bees Mostly Unnecessary

Feeding bees is likely to be expensive. It also makes necessary much extra care and work. The tendency today is to do away with feeding altogether by so managing the colonies that there will be no need for it. This is accomplished by either running the bees in a single body and allowing them a super of shallow frames wholly or partially filled with honey in addition to the stores in the main body of the hive, or, in using, as suggested before, two brood bodies with nine or ten frames each at all times except during the early honey flow and in wintering in these bodies. This latter practice is believed to be the best, especially for strong colonies.

Feeding is at times, however, really necessary to supply a food shortage. Such shortage may possibly occur following the main honey flow as a result of a very dry period when flowers do not yield much, if any, nectar. Again a shortage exists and cannot be at once made up from the field in the case of colonies which are started from package bees or small nuclei. A fair-sized colony of bees and hive parts, but without honey, will

weigh about forty pounds; and since a colony needs about thirty-five to forty pounds of good stores to winter well and to raise large numbers of young bees in the early spring, the difference between seventy-five or eighty pounds and the actual weight of the hive should be fed in the fall in the form of heavy sugar syrup. September is the best month for feeding to make up a shortage. Use two and one-fourth pounds of white granulated sugar to each pint of water. Bring the syrup carefully to a boil, and while boiling add a teaspoonful of tartaric acid for each twenty pounds of sugar to invert the sugar and to prevent granulation. For feeding in early spring in the case of nuclei, or weak colonies, a more dilute syrup may well be used. White sugar which has been scorched or burned and brown sugar syrup are both unsuited for feeding bees, since they are apt to produce dysentery. Honey from unknown sources should not be fed, as it may introduce germs of the foulbrood diseases. When feeding is necessary, it is best to feed the total amount of syrup needed to carry the colony through the shortage period in one or two feedings rather than to feed a little each day. There is probably no better feeder made than a shallow tin plate or cake pan set on a couple of small sticks over the frames inside an empty covered super. Into this tin the syrup is poured, and some shavings or small sticks are placed to keep the bees from drowning.

COLONY RECORDS

If one is to keep more than one or two colonies of bees, it will be found a great advantage and almost a necessity to keep colony records. There are many details to this art of beekeeping, and success will depend on carrying out the different operations which are necessary at the right time. Besides this a record of the performance of each colony will give one the data necessary in deciding from which to breed queens for general improvement of the apiary.

It has been found well to give each colony a number and a separate page in one's notebook. Every time the apiary is visited the notebook will be taken along as part of the regular equipment, and conditions for each colony will be recorded at the time as observed. Records will then read, as, for example:

Colony No. 1

May 1. Has queen—eggs and brood in all stages in 7 frames; gave second body.
June 1. No queen cells—colony conditions good, reduced to one body placing all brood in same and gave first super for comb honey.

WINTERING BEES

The preparation of colonies for winter, and the giving of abundant protection during cold weather, is one of the prime requisites for success in beekeeping in northern New England. The neglect of this is the cause of large losses each winter.

Several conditions are necessary for successful wintering. In the first place, there should be an abundance of young bees hatched in the late fall. This will be secured best by means of a young queen, a well-sheltered location, and some insulation about the hives in the fall. Secondly, to winter well the bees must have plenty of good quality stores. Most kinds of honey are excellent for winter food, but some of the darker honeys contain small amounts of materials other than sugars, not entirely digested by the bees. Mr. F. W. L. Sladen, in charge of beekeeping for the Canadian Government, has stated that in his experience colonies winter better when fed in the late fall ten pounds of thick white syrup in addition to their natural stores.

Colonies to winter well must be strong and should cover at least five or six frames, so as to generate easily the heat required to keep up the normal temperature of the cluster. Phillips and Demuth have shown that the lowest temperature ever recorded in any part of this winter cluster of bees within the hive is 57° F., the so-called "critical temperature" at which bees form a cluster within the hive. It has also been shown that bees generate the heat necessary to maintain this temperature by the consumption of honey or sugar and by physical exertion while in the cluster. The fewer the bees to the cluster and the quicker the heat they generate is lost by radiation or by air currents, the more must the bees eat and work; then comes danger of dysentery and exhaustion resulting in colonies which die, or are so weakened by spring as to be of little value.

Hence, another requisite in wintering is to conserve carefully the heat generated by the bees. This can be done by cellar wintering or by wintering the hives out-of-doors in large cases with packing. Bees are usually placed in the cellar after a warm day, permitting their flight in early November, and are brought out about the time silver

maples are in bloom. Cellar wintering calls for the use of a moderately dry cellar in which the temperature is fairly constant, ranging from 45° to 55°. The cellar must also be absolutely dark, and there must be no jarring or vibration of the hives. Entrances to hives are left open, but may be screened with quarter-inch mesh wire to prevent mice from entering.

Cellar wintering is the best for the severe months, provided a suitable cellar and good stores are at hand. The practice falls short, usually, in that neither in the fall prior to the time the colonies can be put in the cellar, nor in the early spring does it provide sufficient protection to colonies. The incubation temperature for eggs and young bees is about 95° F., and the single wall hive loses heat so rapidly that this temperature cannot be easily maintained during the cold nights of late fall and early spring. For the best interest of the colony and the beekeeper, brood rearing should go on at both these seasons.

Therefore, the plan of wintering colonies out of doors in well-insulated hives is increasing in favor. The hives are placed in large cases with eight to twelve inches of packed dried forest leaves or shavings between the bottom, sides, and top of the hives and the outer case. A tunnel entrance is provided for each hive through the packing to the outside air. Each hive may be given its own winter case, or they may be packed in large cases of two or four.

Careful investigations have shown that the best of insulation is of little value if the hives are placed in wind-swept locations, again emphasizing the necessity of selecting at the start a well-sheltered apiary site.

BEE DISEASES

The two more or less common and important infectious diseases of bees are bacterial in their nature, and are known technically as American Foulbrood and European Foulbrood. As the names indicate, both these diseases attack and kill the brood, or undeveloped bees, and so prevent these hatching out to take the place of older ones which die off from natural causes. Thus the strength of the colony is quickly reduced, and frequently it then becomes an easy prey to bee-moth, which soon completes the work of destruction. Incidentally it may be noted that bee-moth or wax-moth can make no progress in healthy colonies of Italian bees.

Symptoms and major characters of both these diseases are here given. In case one suspects disease but is not able to identify the same with certainty, he should write the Division of Entomology, Department of Agriculture, Washington, D. C., stating the facts as he observes them. The Department will send a free shipping case for a sample of diseased brood and will, where possible, identify the disease. The Department of Agriculture bulletins Nos. 975 and 1084 deal with these diseases, and should be owned and studied by every bee-keeper.

Characteristics of American Foulbrood

(After Phillips)

1. The hive emits a strong odor corresponding to that of cooking glue.
2. American Foulbrood more frequently kills the young bees after they are capped over, and the cappings are often later removed. Scattered cells will often not be affected, and the bees in them will hatch out, giving rise to a patched appearance of the brood comb.
3. The diseased larvae are first a light brown, later changing to a dark or coffee brown.
4. In the later stages the contents of the dead larvae become glue-like, and the putrefying material will string out several inches if a toothpick is pushed into it and gently lifted. This is considered to be the most characteristic feature of the disease.
5. Larvae and pupae dry down to a brown scale which adheres finally to the base and lower or bottom wall of the cell.

Symptoms and characters of European Foulbrood

(After Phillips)

1. The disease usually attacks larvae in younger stages of growth than does the American Foulbrood disease.
2. The affected larvae show a slightly yellow or gray shading. They take on a watery consistency and become more or less translucent. The rings of the body segments show plainly, and often the digestive track throughout the body is visible.
3. Later the translucency is lost, and the larvae assume a distinct gray or yellow shade

and pasty consistency, which later is considered to be the chief distinguishing character of the disease.

4. When dried down, the larval scale does not adhere to the base or the lower wall of the cell.

Another disease of the undeveloped bees is the so-called Pickled-Brood or Sac-Brood. In this case the larvae die at the stage just before or after capping.

Brood may also be killed from chilling in case of a very cold spell following a period of warm weather in early spring.

The writer has been a beekeeper for many years, and each recurring season he has enjoyed the pleasure and recreation of studying and working with these most wonderful and fascinating little insects. He believes the science of bee culture will always afford pleasure and some profit to both men and women who really love nature's ways and the out-of-door life. Beekeeping does not call for a great deal of strenuous work, but rather for judgment, patience and system, and these come through years of study and experience. He suggests that every beekeeper should own at least one or two of the best books on beekeeping, and study these, together with the excellent technical bulletins on the various phases of the subject. Above all else he would recommend the study of the bees themselves, since they are the best teachers of last resort in respect to their own industry.

THE BEEKEEPERS' BOOKSHELF

The following is a partial list of some of the best publications relating to bee culture:

"Productive Beekeeping," by F. C. Pellett, Lippincott Publishing Co., Philadelphia, Pa.
"Beekeeping," by Dr. E. F. Phillips, The Macmillan Co., New York City.
"Fifty Years Among the Bees," by Dr. C. C. Miller, A. I. Root Co., Medina, O.
"Langstroth on the Hive and Honey Bee," revised by C. P. Dadant, published by the American Bee Journal, Hamilton, Ill.
"Advanced Bee Culture," by W. C. Hutchinson, published by A. I. Root Co.
"Practical Queen Rearing," by F. C. Pellett, published by the American Bee Journal.
"How to Keep Bees," by Anna B. Comstock, A. I. Root Co.
"A.B.C. and X.Y.Z. of Bee Culture," A. I. Root Co. This is an encyclopedia of modern beekeeping. Topics arranged alphabetically.
"A Thousand Answers to Beekeeping Questions," by Dr. C. C. Miller, published by the American Bee Journal, Hamilton, Ill.
"Beekeeping for Beginners," by C. P. Dadant, published by the American Bee Journal.

United States Department of Agriculture Farmers' Bulletins (these may be had free on request from the Department, or may be bought from the Superintendent of Public Documents, Washington, D. C.):

No. 447 Bees
No. 1012 Preparation of Bees for Outdoor Wintering
No. 1039 Commercial Comb Honey Production
No. 695 Outdoor Wintering of Bees
No. 1014 Wintering Bees in Cellars
No. 975 Control of European Foulbrood
No. 1084 Control of American Foulbrood
No. 820 Utilization of Sweet Clover
No. 503 Comb Honey

Magazines on Beekeeping

"The American Bee Journal," published at Hamilton, Ill.
"Gleanings in Bee Culture," published at Medina, Ohio.